



Techniques for Source Zone and Plume Characterization of Tetrachloroethene in Fractured Limestone Aquifers

Fjordbøge, Annika Sidelmann; Mosthaf, Klaus; Janniche, Gry S.; Binning, Philip John; Skov, Bent Henning; Keller, Carl; Kern-Jespersen, Henriette; Broholm, Mette Martina

Publication date:
2015

Document Version
Peer reviewed version

[Link back to DTU Orbit](#)

Citation (APA):
Fjordbøge, A. S., Mosthaf, K., Janniche, G. S., Binning, P. J., Skov, B. H., Keller, C., Kern-Jespersen, H., & Broholm, M. M. (2015). *Techniques for Source Zone and Plume Characterization of Tetrachloroethene in Fractured Limestone Aquifers*. Abstract from 2015 NGWA Conference on Groundwater in Fractured Rock, Burlington, Vermont, United States.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

2015 NGWA Conference on Groundwater in Fractured Rock September 28 - 29, 2015

Techniques for Source Zone and Plume Characterization of Tetrachloroethene in Fractured Limestone Aquifers

Monday, September 28, 2015: 9:30 a.m.

Annika S. Fjordbøge , Department of Environmental Engineering, Technical University of Denmark, Kgs. Lyngby, Denmark

Klaus Mosthaf , Department of Environmental Engineering, Technical University of Denmark, Kgs. Lyngby, Denmark

Gry S. Janniche , NIRAS, Allerød, Denmark

Philip J. Binning , Department of Environmental Engineering, Technical University of Denmark, Kgs. Lyngby, Denmark

Bent Skov , Department of Environmental Engineering, Technical University of Denmark, Kgs. Lyngby, Denmark

Carl Keller , FLUTe, Alcalde, NM

Henriette Kerrn-Jespersen , Capital Region of Denmark, Hillerød, Denmark

Mette M. Broholm , Department of Environmental Engineering, Technical University of Denmark, Kgs. Lyngby, Denmark

Characterization of chlorinated solvents in fractured limestone aquifers is essential for proper development of site specific conceptual models and subsequent risk assessment and remediation. High resolution characterization is challenged by the difficulties involved in collection of intact core samples as water flushing during drilling often results in extensive core losses, especially from zones with soft limestone in contact with flint beds. Field investigations with alternative characterization techniques have been carried out at two Danish sites with tetrachloroethene (PCE) contaminated fractured limestone aquifers. The two sites represent different scales (source and plume) and contaminant levels (DNAPL and dissolved). The scope of the investigations was to evaluate different techniques for characterization of the contaminant distribution in the limestone aquifers and to obtain an improved conceptual understanding of contaminant transport.

At both sites limestone cores were collected with significant core losses. The discrete quantification of chlorinated solvents in the retrieved limestone cores was compared to different FLUTe technologies at the DNAPL site and passive and active multilevel groundwater sampling at the plume scale site. Important information regarding contaminant distribution and potential presence of DNAPL was provided by FACT (FLUTe activated carbon technique) and Water-FLUTe multilevel sampling. The data was used to validate a model based tool for interpretation of the FACT field measurements, which allows the conversion of discrete activated carbon concentrations to aqueous concentrations at given hydraulic parameters and FACT parameters. The passive groundwater sampling with snap samplers resulted in significantly different concentration levels and concentration profiles over depth compared to the active sampling by separation pumping with heat pulse technology. The differences between the two techniques decreased with distance to the source area. Overall, the borehole characterization techniques provided an improved conceptual understanding of the contaminant distribution compared to the data obtained by quantification of chlorinated solvents in the limestone cores.